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Research Article

Association of Hygienic Practices and Diarrhea Prevalence: A Cross-Sectional Study in Urban Area of Bangalore

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Abstract

Background and Objective: Diarrhea is the third leading cause of childhood mortality in India and is responsible for 13% of all deaths per year in children under 5 years of age. It most often results from the ingestion of pathogens from faeces that have not been disposed of properly, or from the lack of hygienic practices. According to W.H.O. better sanitation and hygiene could prevent 3,61,000 deaths in children aged under 5 each year. In order to examine the association between preventive sanitary behaviors and diarrhea, this study aimed to evaluate the prevalence of hygienic practices and diarrheal illness in an urban locality of Bangalore, India.

Methods: Across sectional study was undertaken among 480 households in Hegganhalli locality of Bangalore city from January 2016 to December 2016. Systematic random sampling technique was applied to obtain the desired sample size. Information on socio-demographic characteristics, hygienic practices and any diarrheal episode in last 2 weeks in a household was gathered by using pretested, structured questionnaire.

Results: The data on hygienic practices revealed that, 55.6% respondents were not following any methods of drinking water treatment and 40% respondents store water in uncovered containers. Diarrhea within the Past 2 weeks was reported from 76 households. Present study identified six factors that were significantly associated with diarrheal episodes. These are socio-economic status (p=0.01), family size (p=0.01), water storage practices (p=0.001), water handling practices (p=0.01), frequency of waste disposal (p=0.004) and hand washing material (p=0.03).

Interpretation and Conclusion: The study revealed poor drinking water handling and storage, improper solid waste disposal and hand washing without soap are major factors associated with diarrheal diseases. Effective diarrhea control requires a change in the behavior and hygienic practices of community dwellers. Hence, there is a need for implementation of behavioral change communication to improve the sanitation and hygiene practice.

Keywords: Diarrhea; Socio-demographic factors; Hygienic practices; Bangalore

Introduction

Diarrhea is the leading killer disease of children, accounting for 9 percent of all deaths among children under age 5 worldwide in 2015. This translates to over 1,400 young children dying each day, or about 526,000 children a year [1]. In India, diarrhea caused more than 130,000 child deaths in 2013 [2]. Much of ill health in India is due to poor environmental sanitation that is unsafe water and unhygienic disposal of human excreta and refuses [3].

According to W.H.O. better sanitation and hygiene could prevent 3, 61,000 deaths in children aged under 5 each year [4]. Studies have revealed that three key hygiene practices i.e. safe disposal of faeces, hand washing with soap at critical times, and safe treatment and storage of drinking water are the most effective ways in reducing water borne disease prevalence [5]. Safe storage and treatment of water at point of use brings about approximately 30 to 50% reduction, hand washing with soap over 40% reduction and safe disposal of faeces approximately 30% reduction in disease prevalence [4].

Though the health burden of diarrheal diseases is widely recognized at the global level, there is limited information available on its prevalence and the hygienic practices contributing to its occurrence in urban settings. The lack of appropriate information on practices of sanitation and hygiene is an impediment to identify priority needs to be addressed. Thus, present study was conducted to obtain baseline information on the existing hygienic practices and diarrhea prevalence in target population. The findings of the study will be helpful in designing context-specific IECs and strategies to prevent or minimize diarrheal disease. Furthermore, it may also serve as a baseline data for further studies.

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Table 1: Socio-demographic characteristic of study population.

Variables	Frequency	Percent	Mean ± SD
Age (Years)			
≤40	350	72.9	35.4 ± 11.9
> 40	130	27.1	
Gender			
Male	153	31.9	-
Female	327	68.1	
Religion			
Hindu	288	60	-
Muslim	187	39	
Christian	5	1	
Socio-economic status			
Upper Lower	273	56.9	-
Lower Middle	178	37.1	
Upper Middle	29	6	
Family size			
1-2	49	10.2	3.9 ±1.2
3-5	382	79.6	
6-10	49	10.2	

Table 2: Hygiene practices of study population.

Variables	Frequency	Percentage
Drinking treated water		
Yes	213	44.4
No	267	55.6
Method of treating water[a]		
Boiling	68	31.9
Filtration	115	54
Others	30	14.1
Storage of drinking water		
In uncovered container	192	40
In covered container	288	60
Frequency of cleaning drinking water storage container		
Daily	77	16
Not daily	403	84
Method of collecting drinking water from storage container		
By using cup with handle	276	57.5
Not using cup with handle	204	42.5
Solid waste collection inside the house		
In plastic bags	62	12.9
In plastic dustbins/buckets	408	85
Others	10	2.1
Frequency of waste disposal		
Daily	380	79.2
Not daily	100	20.8
Means of waste disposal		
Municipality van	258	53.8
Community dustbin	219	45.6
In open drain/yards	3	0.6
***Key times for Hand washing**		
After defecation	450	93.8
Before handling food	446	92.9
Always when hands are dirty	315	65.6
After cleaning children	157	32.7
Hand washing material		
Water and soap	334	69.6
Water only	146	30.4

[a]Among respondents who answered that they treat drinking water before use.
*Multiple responses are reported.

Methods

Study design and setting

A community-based cross-sectional study was conducted in Hegganhalli locality of Bangalore city from January 2016 to December 2016. According to census report 2011 [6], study area (Hegganhalli, BBMP Ward no.71) had a population of 66000 comprising of 54% males and 46% females. It has about 18000 households with an average family size of four. Present study covered 2.7% households in the project area.

Sample size and sampling techniques

The computation of optimum households sample size was based on the formula below [7].

$$N = \frac{\left[Z^2 P(1-P)\right]}{d^2} \times \frac{d_{\text{eff}}}{\text{R}}$$

Estimated sample size was 384 households (increased to 480) (by assuming 95% confidence level, and design effect of 1.2 for using other than Simple random sampling with a response rate of 80% with a conservative estimate of 50% prevalent sanitary practices).

Systematic random sampling technique was applied to obtain the desired sample size. The sampling interval (k) was calculated as k=N/n. Since the total households in this locality were about 18000; the sampling interval (18000/480) came out to be 37.5 ~ 37. The sampling was started by selecting a house from the list at random and then every 37th house in sampling frame was selected till the sample size was achieved.

Ethics and consent procedure

The study was started following approval of the study protocol by the Institutional Ethics Committee, NIUM, Bangalore vide IEC No: NIUM/IEC/2014-15/016/TST/02. Formal permission was taken from the concerned authorities in the selected locality. An informed written consent was obtained from all the participants. Participants were also provided with an information sheet containing the research objectives, data collection method, role of participants etc. They were given enough time to go through the study details mentioned in the information sheet. They were also given opportunity to ask any question concerning the study. Respondents were informed that they could choose to or not to participate in the study. Only after they agreed to participate in the study, they were asked to sign

Table 3: Association between socio-demographic variables and hygiene practices.

Variable	Good practices	Fair practices	Poor practices	χ^2	p value
Age					
≤40	70	130	150	2.195	0.33
>40	25	40	65		
Gender					
Male	38	52	63	0.087	0.95
Female	83	114	130		
Religion					
Hindu	66	80	142	0.767	0.94
Muslim	39	51	97		
Christian	1	2	2		
Socio-economic status					
Upper Lower	61	69	143	18.31	0.001*
Lower Middle	46	70	62		
Upper Middle	9	12	8		
Family size					
1-2	15	23	11	13.01	0.01*
3-5	74	142	166		
6-10	7	14	28		

*P < 0.05

the informed consent form. Illiterate respondents were explained about purpose of study and then their thumb impression was taken. Mentally challenged persons and those who refused to give consent were excluded from the study. The respondents were informed that all responses would be noted down but would be kept confidential at all times. Strict confidentiality was maintained in data handling.

Method of data collection

Data was collected from individual households through house to house survey of the selected locality. The survey was conducted by the investigator accompanied with volunteers from the selected locality. Survey was carried out in morning as well as evening hours to get maximum number of study subjects at home. Efforts were made to interview the head of the household. Before interviews were conducted, the investigator asked prospective respondents; whether they are head of the household, if not then their relationship with the head of the household was enquired. If respondents were minors, they were asked to summon a person of maturity age; if anyone was not present in the house at the time, the investigator moved on to another household. Selected households were followed up at least twice in case of unavailability of the respondent on the first visit. A respondent who could not be contacted even after the second attempt was counted as a non-responder. In case of more than one household (family) living in a single house, one was randomly selected.

Data collection tool

The participants were requested to give 20-30 minutes of their time for completion of questionnaire. The questionnaire was designed in English, translated into the local language-Kannada, and pre-tested for any translation errors. Questionnaire consisted of three sections:

Section-1 Contained demographic variables such as age, sex, religion, education, occupation, income of the family and family size etc.

Table 4: Reported diarrhoeal cases.

Variable	Frequency	Percent
Diarrhoea in household in last 2 weeks		
Yes	76	15.8
No	404	84.2
Consult doctor during diarrhoea*		
Yes	22	28.9
No	54	71.1

*Among respondent who answered that there was an episode of diarrhoea in household.

Section-2 Contained questions to assess the self-reported practices regarding sanitation and hygiene like water treatment practices, water storage practices, hand washing practices, means of solid waste disposal, frequency of solid waste disposal etc. There were 10 multiple choice questions for this section. A score of "1" (one) was given for sanitary practices and "0" (zero) score was given for insanitary practices. Practices score was arbitrarily classified as good (>7/10), fair (7-5/10) and poor (<5/10).

Section-3 Contained questions to assess the diarrhoeal disease morbidity. Information was sought regarding any diarrhoeal episode has occurred in last two weeks, and consultation with doctor during diarrhoeal episode. Diarrhoea, the primary outcome variable of this study, was defined as the passage of three or more loose or watery stools in 24 hours [8].

Data processing and analysis

All narrative data was collected under three pre-determined broad categories: Demographic data, sanitation and hygiene practices and diarrhoeal disease morbidity. Each completed questionnaire was manually checked before it was tabulated in Microsoft Excel 2007. The data was analyzed using the statistical software namely SAS 9.2, SPSS 15.0, Stata 10.1, MedCalc 9.0.1, Systat 12.0 and R environment ver.2.11.1. Chi-square/Fisher Exact test have been used to find the significance of study parameters on categorical scale between two or more groups, non-parametric setting for qualitative data analysis. P value <0.05 was considered statistically significant.

Results

Socio-demographic characteristics

Average age of the respondents was 35.4 years (SD=11.9) and majority of them were females (n=327, 68.1%). 60% (n=288) respondents were Hindus. 56.9% (n=273) were from upper lower class. Average household size was 3.9 (SD=1.2) (Table-1).

Hygiene practices

Table-2 shows hygiene practices of respondents. 55.6% (n=267) respondents were not following any methods of water treatment because they felt that water was already cleaned/filtered and did not require additional treatment. Filtration was the most common method of treating water among the respondents, who reported that they treat water before use. Community dwellers were more likely to store water in a covered container (60%) and 84.0% (n=403) respondents reported that they cleaned their water storage containers

on alternate days. More than half (57.5%) of the respondents reported that they used cup with handle to collect drinking water from storage container. Majority of the respondents (86%) reported that they collected the solid waste in plastic dustbins/buckets inside their houses and disposed it daily (79.2%) in municipality vans (53.8%). The most common time for hand washing mentioned by 93.8% of the respondents was 'after defecation' followed by hand washing 'before handling food' (92.9%). Majority of the respondents (69.6%) reported that they washed their hands with soap and water.

Table-3 shows association between socio-demographic variables and hygiene practices. Significant association was found between sanitation and hygiene practices and socio-economic status (χ^2=18.314 p=0.001), and family size (χ^2=13.007 p=0.01). No significant association was found with age (χ^2=2.195, p=0.33), gender (χ^2=0.087, p=0.95) and religion (χ^2=0.767, p=0.94).

Diarrhoeal disease episodes

Table-4 shows the diarrheal occurrence and measures undertaken by study participants. In the preceding 2 weeks of survey 76 households reported diarrhoea cases, affecting 15.8% of the study population. Among respondents who answered that there was an episode of diarrhoea in household, only 28.9% consulted a doctor during an episode of diarrhoea. Present study identified six factors that were significantly associated with diarrhoeal episodes. These were socio-economic status (χ^2=8.50, p=0.01), family size (χ^2=8.25, p=0.01), water storage practices (χ^2=13.88, p=0.001), water handling practices (χ^2=6.01, p=0.01), frequency of waste disposal (χ^2=7.96, p=0.004) and hand washing material (χ^2=4.59, p=0.03) (Table 5,6).

Discussion

In this cross-sectional study of hygienic practices and diarrheal illness conducted in urban setting of Bangalore, the sanitation and hygiene practices among community dwellers were found to be poor. Low standards of sanitation and hygiene practices are anticipated as majority of respondents belonged to lower socio-economic class. Johnson CR et al (2015) has reported that socioeconomic status has been identified as the main factor positively associated with improved sanitation [9].

The proportion of the study population affected by diarrhoea (15.8%) was quite low as compared to previous studies probably due to the shorter recall period of 2 weeks kept in this study. Although all attempts were made to ensure genuine replies from the respondents, under-reporting cannot be ruled out.

This study identified six important factors that were significantly associated with diarrhoeal episodes. These factors were: family size, socio-economic status, water storage practices, water handling practices, frequency of waste disposal and hand washing with soap. The outcome of this study is in line with the previous studies.

Elizabeth et al. (2014) (OR=11.5) and Wondwoson W (2016) had identified a significant association between diarrhoea incidence and increased household size [10,11]. Wondwoson W (2016) reported that the occurrence of diarrhoea was 4.3 times more likely to be higher among households with two children compared with households with only one child [AOR = 4.3, 95% CI = (2.9, 6.3)].

Similarly, the likelihood of diarrhoea occurrence was also 22.4 times higher among households with three children compared with households who had one child [AOR = 22.4, 95% CI = (7.8, 64.5)] [11]. This can be justified by the fact put forward by Blacker [12] that when many people live together, the chance of contact with pathogens increases and hygiene may deteriorate. Furthermore, children who get diarrhoeal disease may easily transmit the disease to others who live in the same area.

Table 5: Association between socio-demographic variables and diarrhea.

Variable	Diarrhoea		χ^2	P value
	No	Yes		
Religion				
Hindu	242	46	0.08	0.958
Muslim	158	29		
Christian	4	1		
Socioeconomic-status				
Upper Lower	219	54	8.5	0.01*
Lower Middle	161	17		
Upper Middle	24	5		
Family size				
1-2	45	45	8.25	0.01*
3-5	324	324		
6-10	35	35		

*P < 0.05

Wondwoson W et al. (2016) reported that the occurrence of diarrhoea was 1.6 times higher among children from economically weaker families compared to children from families with medium income [AOR=1.6, 95% CI =(1.0, 2.2)] [11]. It is quite obvious that families with high socio-economic status are more health conscious and they may have greater opportunity to protect microbial contamination in water in comparison to families of lower socio-economic status.

Study conducted by Jinadu et al. revealed that poor storage of drinking water is significantly associated with high incidence of diarrhoeal episodes [13]. Similarly, study conducted by Dilaram Acharya et al., (2017) found that children whose mothers used uncovered water at the household suffered from diarrhoea more frequently than their counterparts whose mothers did not use uncovered water [(AOR 2.14; 95% CI: 1.09-4.19)] [14]. Knight et al. stated that regardless of where or how the water is collected, storage of water in wide opened vessels such as pots or buckets easily allow contamination through introduction of cups, dippers or hands [15].

Ekanem et al. reported indiscriminate disposal of solid waste is associated with significant increase in diarrheal incidence [16]. In a study conducted by Rego et al., (2005) exposure to garbage in the environment was found to be the most important factor associated with diarrhoea (adjusted odds ratio [AOR]=3.98, 95% CI, 1.56-10.13) [17]. This may be due to the fact that solid and liquid waste disposal provides breeding for various insects which may carry diarrhoea pathogen from the refuse to food and water. This might be responsible for the increase in diarrheal episodes as it is an important aspect for faecal-oral route of disease transmission.

In a meta-analysis, Regina et al., (2015) concluded that hand washing promotion might reduce diarrheal episodes by 30% [18]. It was concluded that washing hands with soap removes transient

Table 6: Association between hygiene practices and diarrhea.

Variable	Diarrhoea		χ^2	P value
	No	Yes		
Drinking water treatment				
Yes	184	29	1.41	0.234
No	220	47		
Storage of drinking water				
In uncovered container	147	45	13.88	0.001*
In covered container	257	31		
Frequency of cleaning of drinking water storage container				
Daily	65	12	0.004	0.947
Not daily	339	64		
Method of collecting drinking water from storage container				
By using cup with handle	242	34	6.01	0.01*
Not using cup with handle	162	42		
Solid waste collection				
In plastic bag	56	6	2.37	0.305
dustbin/buckets	339	69		
Others	9	1		
Frequency of waste disposal				
Daily	329	51	7.96	0.004*
Not daily	75	25		
Hand washing material				
Water and soap	289	45	4.59	0.03*
Water only	115	31		

*P < 0.05

potential pathogenic organisms from hands. Individuals who wash hands are less likely to transmit pathogens from their hands to mouth. They are also less likely to transfer pathogens from their hands to others hand, to food or the environment that is shared with others. Thus, washing hands interrupt transmission of diarrheal pathogens sufficiently, to reduce markedly diarrhoeal episodes.

Limitation of the Study

We acknowledge that short duration recall period (2 weeks), resulted in lower than actual prevalence of diarrhoea, a longer recall period might have given a better picture of diarrhoeal prevalence in the community. Secondly, participants were asked only about diarrhoeal episode in household in last 2 weeks; information with respect to age and sex of those who suffered from diarrhoea was not enquired. This limited insight into association of diarrheal episodes with age and sex. Thirdly, social desirability bias could have occurred during determination of diarrhoeal occurrence based on account of respondents without confirmation of the reported diarrhoeal events by physicians. Though to minimize this bias, volunteers local to the community were also involved in data collection, its complete elimination cannot be guaranteed.

Conclusion

An obvious conclusion that can be drawn from the data produced by the current study that poor drinking water handling and storage, improper solid waste disposal and hand washing without soap are major factors associated with diarrhoeal diseases. Effective diarrhoea control requires a change in the behaviour and hygienic practices of community dwellers. Hence, there is a need for implementation of behavioural change communication for the desired improvement in sanitation and hygiene practices. This simply means that community dwellers should be taught about health hazards associated with poor sanitation and hygiene, maintenance of acceptable standards of cleanliness in their homes and surroundings and how these practices relate to the prevention of hygiene-related diseases.

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